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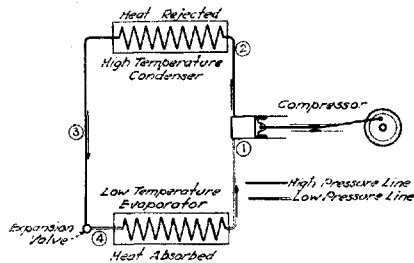
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Heating By Reversed Refrigeration

By FRANKLIN A. ENRIQUEZ, AE II

TODAY, with the advancement of air conditioning, small refrigerating units are being used for heating purposes during winter and as cooling devices during the summer. Greatest efficiency is obtained when maximum capacity of the system is used at all times throughout the year. Also, the system gives better performance where the amount of heating during winter is about the same as the amount of cooling during summer.

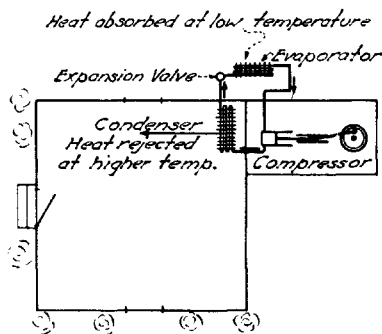
A refrigerator is commonly known to the engineer as a Heat Pump. That is, heat is pumped from a lower temperature to a higher one. In the case of the mechanical compression refrigerator, shown in figure 1, the refrigerant at (1) is in the form of a vapor at low temperature and



Courtesy Engineering Experiment Station News

Figure 1

pressure. Then at the compressor the temperature and pressure become very high. From the compressor the refrigerant passes to the condenser where the vapor rejects heat and the refrigerant becomes a liquid. The heat rejected can be removed by the air or water in contact with the coils of the condenser. The liquid refrigerant in passing through the expansion valve

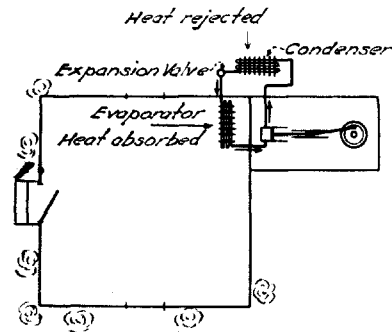


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Figure 2

between (3) and (4) loses some heat and its pressure is lowered, the refrigerant being vaporized to some extent. Then at the evaporator, all the liquid is vaporized completely by the heat absorbed from the coils of the evaporator.

In the household refrigerator the heat abstracted from the refrigerating box is rejected into the surrounding air. Therefore, this refrigerating cycle which is used for cooling purposes can be used in reverse to heat homes during winter if the evaporator is placed outdoors and the con-



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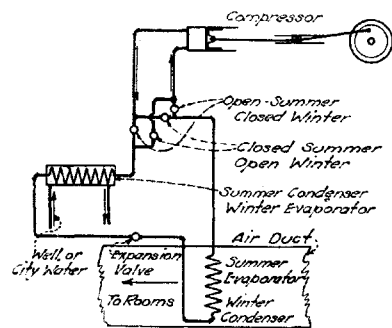
Figure 3

denser indoors, as shown in figure 2. Figure 3 shows the use of a refrigerator for cooling purposes during the summer.

The Heat Pump will work best, according to theoretical standards, when the absolute temperature of the condenser T_2 , and the absolute temperature of the evaporator T_1 maintain the following ratio:

$$\text{C.O.P.} = \frac{T_1}{T_2 - T_1}$$

This ratio is called the "Coefficient of Performance" and it is a measure of the efficiency of the



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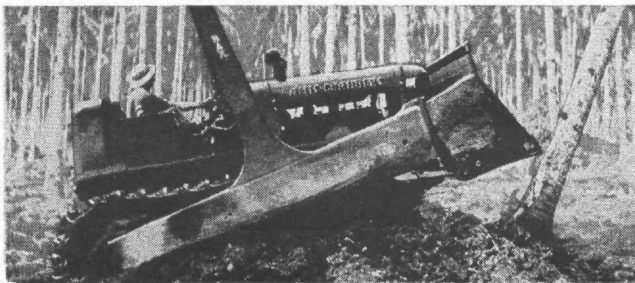
Figure 4

cycle. Since this ratio should be as high as possible, in mild weathers where T_1 temperature at which the heat is absorbed, is large, the C.O.P. will also be large.

A system of operation during summer and winter is shown in figure 4. Here the same coils that
(Continued on Page 24)

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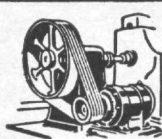
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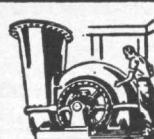
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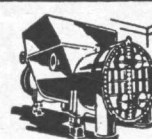
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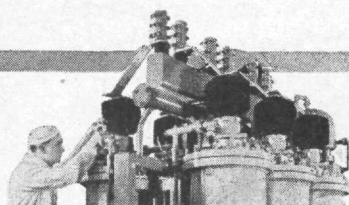
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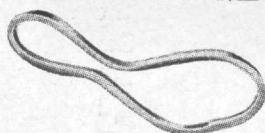
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HEATING BY REVERSED REFRIGERATION

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are used during the winter to provide heat are used in summer to abstract heat. For large heating units this system proves to be very desirable over the direct heating by electricity or other common methods. In actual cases, with favorable conditions, heating by reversed refrigeration saves space and cost of operation. In most of the cases an electric motor is used to drive the compressor, but in some cases a gas engine is used. When a gas engine is used, the heat rejected by the engine can be advantageously used. When the electric motor is used, experimental results from machines installed in large buildings, show that for the same energy input to the motor the heat pump has a larger efficiency than that of electric heaters. However, it must be understood that for heating purposes only, the heat pump is not very adequate, but where an air conditioning system is to be installed, a heat pump is highly desirable.